AMENDMENTS TO THE SPECIFICATION

Please amend the Specification as follows. Insertions are shown underlined while deletions are ~~struck through~~.

The title of the invention:

~~Apparatus~~Control System for Optimizing ~~Control System of Unit Device Integrated in~~ The Function of Machine Assembly Using GA-Fuzzy Inference

The paragraph beginning at page 6, line 1:

Figures 1b and 1c illustrate other embodiments of the optimization system, wherein the control module comprises a main control module and an auxiliary control module, and step (b) is conducted on the auxiliary control module. In Figure 1b, the main control module and the auxiliary control module are arranged in series. In Figure 1c, the main control module and the auxiliary control module are arranged in ~~a line~~parallel.

The paragraph beginning at page 9, line 28:

Figure 4 is a block diagram illustrating an inner structure of a control device 400. The control device 400 includes a constant speed navigation control section 403, and an acceleration optimization control unit 408. In Figure 4, a structure with respect to the constant speed navigation control section 403 is shown (a structure with respect to the acceleration optimization control unit 408 is shown as an acceleration optimization control section 504 in Figure 5). The constant navigation control section 403 has a boat operation fuzzy control module 407, an autonomous evolutionary process unit 405, a boat-operation characteristic evaluation unit 406, and an interactive evolutionary process unit 404. The boat operation fuzzy control module 407 determines an opening of an electronic throttle valve for an electronic throttle 410 and a trim angle for a trimming apparatus 411 in response to predetermined input information. The autonomous evolutionary process unit 405 optimizes standardized coefficients of the boat operation fuzzy control module 407. The boat-operation characteristic evaluation unit 406 evaluates the autonomous evolutionary process unit 405. The interactive evolutionary process unit 404 optimizes the fuzzy rules of the boat operation fuzzy control module 407.

The paragraph beginning at page 10, line 8:

Figure 5 is a block diagram illustrating an inner structure of a control device ~~5~~400 with respect to the acceleration optimization control unit 408. The structure with respect to the constant speed navigation control unit 403 is shown in Figure 4. ~~An~~The acceleration optimization control unit ~~504~~408 includes a trim control module 508, an autonomous evolutionary process unit 506, an acceleration characteristic evaluation unit 507, and an interactive evolutionary process unit 505. The trim control module 508 determines a trim angle for ~~a~~the trim apparatus ~~5~~411 in response to predetermined input information. The autonomous evolutionary process unit 506 optimizes control parameters of the trim control module 508. The acceleration characteristic evaluation unit 507 evaluates the autonomous evolutionary process unit 506. The interactive evolutionary process unit 505 optimizes control parameters of the trim control module 508.

The paragraph beginning at page 10, line 27:

Figure 6 illustrates relationship between standardized coefficients of ~~a~~the boat operation fuzzy control module ~~60~~407 and individuals produced by encoding them. The speed is applied to standard coefficient S1; the acceleration, S2; the throttle opening, S3; the steering angle, S4; and the engine speed, S5. Each of the information is applied to the boat operation fuzzy control module ~~60~~407 through its corresponding standard coefficient. The boat-operation fuzzy control module ~~60~~407 outputs the electronic throttle valve opening variation and the trim angle variation through the corresponding standard coefficient S6 and S7, respectively.

The paragraph beginning at page 11, line 3:

The autonomous evolutionary process unit in the constant speed navigation control unit uses a genetic algorithm, and encodes the standardized coefficients of the boat operation fuzzy control module ~~60~~407 as shown in Figure 6 to produce individuals. In Figure 6, inputs from the interactive evolutionary process unit 404 and the autonomous evolutionary process unit 405 are not shown (see Figure 4). The autonomous evolutionary process unit optimizes the standardized coefficients by using the genetic algorithm. With regard to evaluation of each individual during autonomous evolutionary process, regarding boat operating characteristics, higher evaluation values are provided by the evaluation unit as an error between an actual speed and a reference a

Q7 Amd.

user has fixed gets closer to a desired range. As a result, the standardized coefficients of the boat operation fuzzy control module ~~60~~407 are automatically optimized towards the desired boat operating characteristics, and an optimal boat operating characteristic is obtained even when the use environment changes or the hull moves inappropriately.

The paragraph beginning at page 11, line 18:

Q8

Figure 7 illustrates relationship between a fuzzy rule table of the boat operation fuzzy control module and individuals produced by encoding part of it. The ~~autonomous~~interactive evolutionary process unit uses a genetic algorithm, by which part of the fuzzy rule table for the boat operation fuzzy control module is encoded to produce the individuals, and optimizes the part of the fuzzy rule table using the genetic algorithm. The evaluation of each of the individuals during the interactive ~~optimum~~evolutionary process is done based on the comfortableness of the ride the user experiences. As a result, the part of the fuzzy rule table is optimized based on the evaluation of the user to produce an optimal boat operating characteristic suitable for the user's evaluation.

The paragraph beginning at page 12, line 26:

Q9

In the case of cruising where a high speed of an engine is used, unstable movements are produced such as pitching that moves a hull upward or downward and Dutch roll that moves a hull in leftward or rightward. When pitching or Dutch roll is detected by sensors, zero is given as an individual evaluation value and a trim angle is reduced till pitching or Dutch roll is prevented from producing, which leads to the hull being stable. The trim angle at that time is called a maximum trim angle. Each individual is evaluated based on the maximum trim angle, which can prevent unstable movements from generating at a high speed.

The paragraph beginning at page 13, line 1:

Q10

Based on the evaluation value of each individual derived by the evaluation value calculation ~~process~~method ~~(step 1-2)~~, it is evaluated whether the evaluation value is an optimal boat operation characteristic (step 1-3). As a result of the evaluation, it is decided whether an optimal boat operation characteristic is obtained (step 1-4). If the optimal boat operation

Q10 & amend.

characteristic is obtained, the evolutionary process is finished. If not, the process proceeds to an evolutionary calculation module to generate individuals of the next generation (step 1-5).

The paragraph beginning at page 14, line 9:

Q11

~~The above process, by which~~If the desired boat operation characteristics are not obtained, the above process is repeated till the number of stipulated generations is reached. As a result, a part of the fuzzy rule table for the boat operation fuzzy control module is replaced by the fuzzy rules for the individuals obtained, and the total table used in step 2-3 is initialized to zero (step 2-13).

The paragraph beginning at page 14, line24:

Q12

The trim control module outputs a trim variable with respect to speed as shown in Figure 5.

The paragraph beginning at page 15, line 15:

Q13

Figure 13 shows one example of individuals used in an autonomous evolutionary process unit in an acceleration optimization control section. In the figure, control parameters for a trim control module–trim out initial speed T1, trim operation speed T2, and final trim angle T3–are shown. The autonomous evolutionary process unit employs a genetic algorithm. The control parameters are encoded to produce individuals and are optimized using the genetic algorithm. Evaluation of each individual during the autonomous evolutionary process is conducted by an evaluation unit, where an evaluation value is higher as a desired acceleration characteristic, for example, time from stop of a boat to a predetermined speed becomes shorter. Accordingly, the control parameters of the trim control module are automatically optimized to the desired acceleration characteristic (the bold line in Figure 12). Even when a use environment or a hull changes, an optimum acceleration characteristic can be obtained.

The paragraph beginning at page 16, line 3:

Q14

Switching over between the autonomous evolutionary process unit and the interactive evolutionary process unit (step I in Figure 8) can be based on time or user's intention through

~~the~~an interface 100 shown in Figure 10. To be specific, The autonomous evolutionary process unit performs evolutionary process where an optimum acceleration characteristic is produced. Based on the optimum acceleration characteristic, the interactive evolutionary process unit conducts interactive evolutionary process and a fine adjustment may be made to meet a user's preference. When an individual a user does not like is produced during the autonomous evolutionary process, the user may give a zero evaluation value at the scene to change to the next individual.

The abstract of the disclosure:

The invention provides an optimization device for a unitary apparatus that can obtain optimum characteristics as a combined apparatus, without losing user's selectivity and unitary apparatus's versatility. The optimization device includes an optimization process section that ~~in real time~~ optimizes dynamic characteristics of the unitary apparatus using genetic algorithms and fuzzy inference, with functional characteristics of a combined apparatus as evaluation reference.